Jan. 7, 1936. J. P. JOHNSON 2,026,739

PUMP

Filed April 8, 1933 2 Sheets-Sheet 1

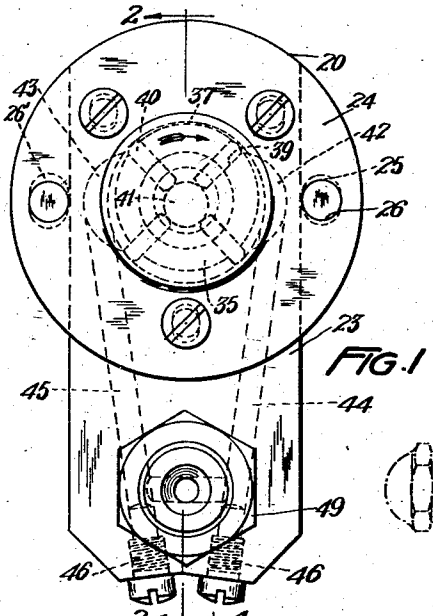


FIG. 1

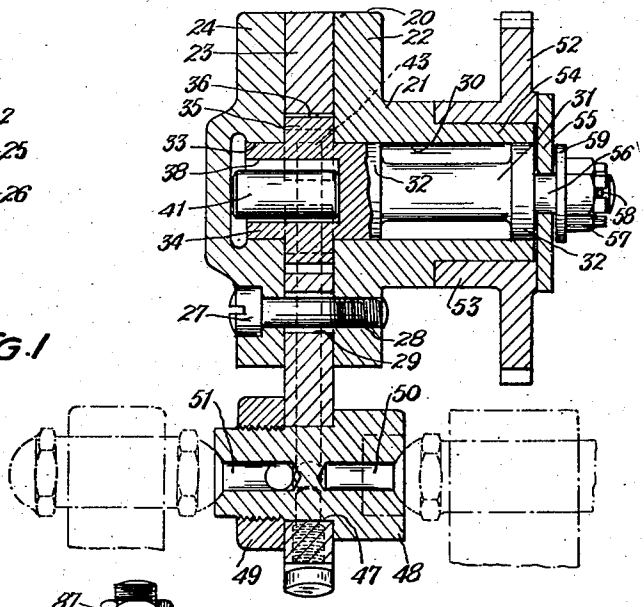


FIG. 2

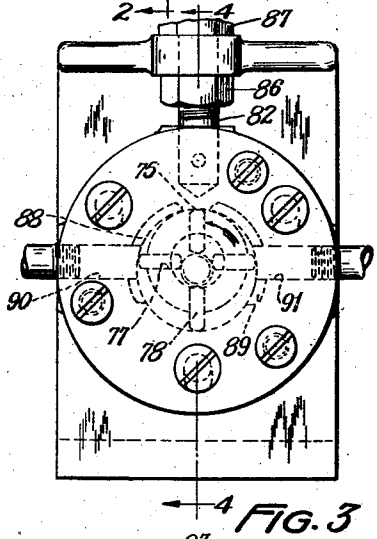


FIG. 3

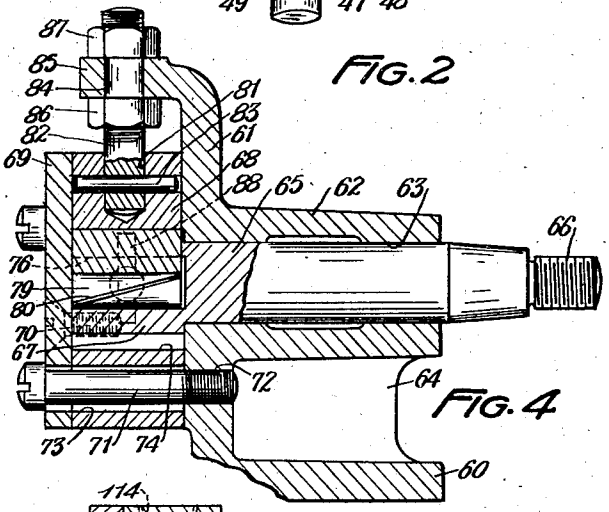


FIG. 4

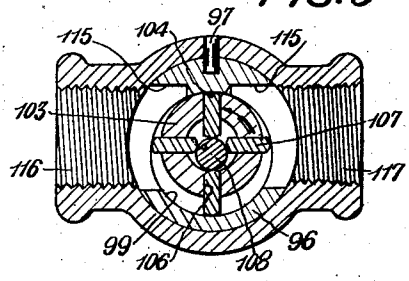


FIG. 6

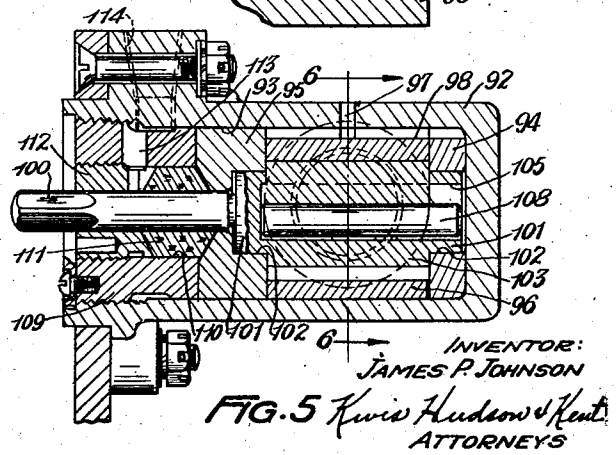


FIG. 5

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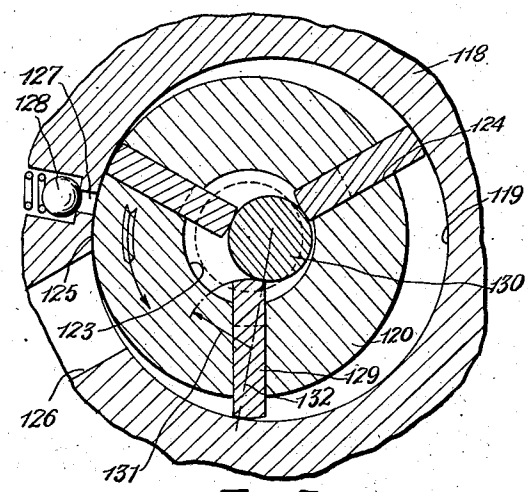


FIG. 7

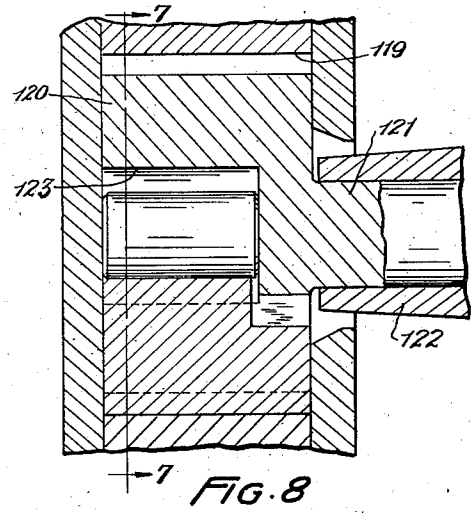


FIG. 8

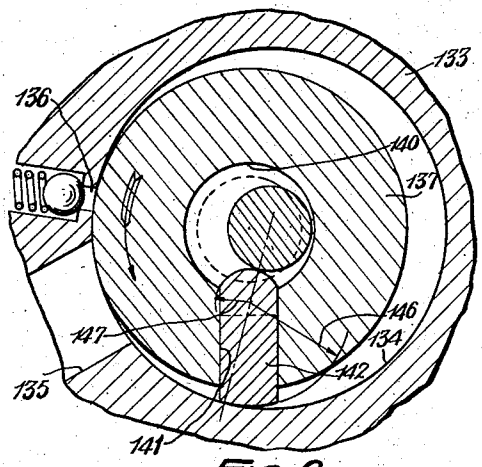


FIG. 9

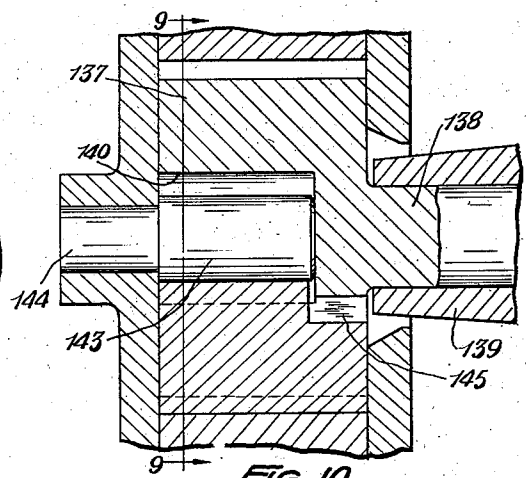


FIG. 10

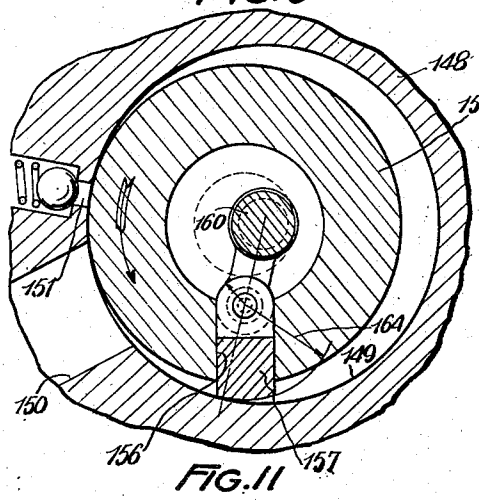


FIG. 11

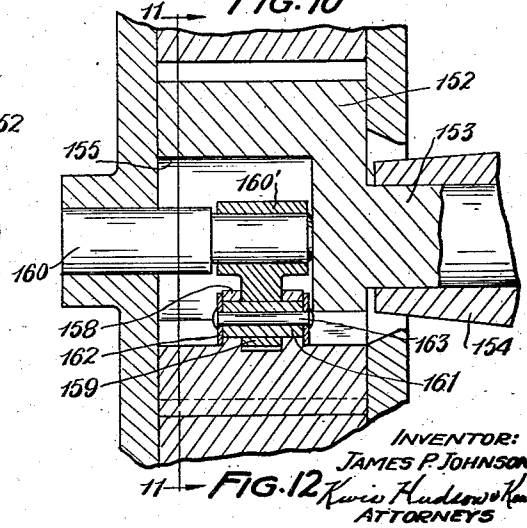


FIG. 12

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UNITED STATES PATENT OFFICE

2,026,739

PUMP

James P. Johnson, Shaker Heights, Ohio

Application April 8, 1933, Serial No. 665,121

7 Claims. (Cl. 103—137)

The present invention relates to rotary pumps or motors and has for its primary object to provide such a device which is simple in construction, efficient in operation and inexpensive to manufacture.

A further object of the invention is to provide the rotor of the pump or motor with one or more slidable blades, removable and replaceable in the event of injury or excessive wear, and so formed as to distribute the wear substantially equally over the entire engageable surfaces.

A further object of the invention resides in providing a bearing roller, secured or freely rotatable as may be desired, with which the inner ends of the slidable blades engage, and which is replaceable by a roller of larger diameter in the event of wear upon the slidable blade or blades so as to maintain a running fit between the outer end of each blade and the adjacent engageable surface of the pump housing.

A further object of the invention is to provide a pump or motor of the type referred to in which adjustment may be made to vary the capacity thereof.

With the objects above indicated and other objects hereinafter explained in view the invention consists in the construction and combination of elements hereinafter described and claimed.

Referring to the drawings:

Figure 1 is an end elevational view of a pump or motor embodying one form of the present invention;

Fig. 2 is a longitudinal vertical sectional view taken on line 2—2 of Fig. 1;

Fig. 3 is an end elevational view of a pump embodying a modification of the invention;

Fig. 4 is a longitudinal vertical sectional view taken on line 4—4 of Fig. 3;

Fig. 5 is a longitudinal vertical sectional view of a pump embodying a further modification of the invention;

Fig. 6 is a transverse sectional view taken on line 6—6 of Fig. 5;

Fig. 7 is a transverse sectional view taken on line 7—7 of Fig. 8 and showing one form of blade and mounting therefor;

Fig. 8 is a longitudinal vertical sectional view of the arrangement shown in Fig. 7;

Fig. 9 is a transverse sectional view taken on line 9—9 of Fig. 10 and showing a modified form of blade and mounting therefor;

Fig. 10 is a longitudinal vertical sectional view of the arrangement shown in Fig. 9;

Fig. 11 is a transverse sectional view taken on line 11—11 of Fig. 12 and showing a further modified form of blade and mounting therefor, and

Fig. 12 is a longitudinal vertical sectional view of the arrangement shown in Fig. 11.

In the drawings several constructions are illustrated all embodying the present invention, but each being particularly adaptable for use in various connections, as will be later described. In Figs. 1 and 2 of the drawings an adjustable metering pump is shown which consists of a housing generally indicated by the numeral 20. This housing has a rear portion 21 provided with a laterally extending annular flange 22 of any desired diameter. A substantially rectangular plate 23 has one of its sides engageable with the adjacent side of the flange 22, while its opposite side is engageable with the inner adjacent side of a cap 24 which may be circular, as shown, and of a diameter preferably the same as the diameter of the flange 22, the said cap and flange members being coaxially assembled. Dowel pins 25 are preferably mounted upon the flange member 22 and extend outwardly through aligned openings 26 provided in the cap 24 and elongated openings 26' in the member 23, as more clearly shown in Fig. 1, to definitely position the cap 24 with respect to the flange 22. The flange 22, member 23 and cap 24 are maintained in assembled relation by means of bolts 27 extending through aligned openings in the members and having screw threaded engagement with the flange 22, as indicated at 28. The openings 29 in the member 23 through which the bolts 27 extend are elongated in a vertical plane, as shown in the views referred to, to permit the member 23 to be vertically adjusted with respect to the flange 22 and cap 24 for a purpose to be later described.

The member 21 is provided with an axial bore 30 to rotatably receive therein a shaft 31 having enlarged bearing portions 32 spaced apart and engageable with the inner surface of the bore 30. Concentric with the bore 30 is a counterbore 33 provided upon the inner side of the cap 24 which rotatably receives an enlarged bearing portion 34 provided upon the outer end of the shaft 32. Formed integral with the shaft 31 and between the adjacent bearing portions 32 and 34 is a circular rotor 35 of larger diameter than the diameter of the bearing portions 32 and 34, but concentric with the axis of the shaft 31. This rotor 35 is of substantially the same depth as the member 23 and is rotatable within a transverse opening 36 provided in the member 23. This transverse opening 36 provides a circular fluid chamber and has an axis which is eccentric to the axis

of the shaft 31. The peripheral surface of the rotor 35 is normally in running engagement with the upper inner surface of the chamber at a point indicated by 37 in Fig. 1, and which point of running engagement is normally located between the inlet and outlet passageways, as will be later referred to. The outer end of the shaft 31 adjacent the bearing portion 34 is provided with a bore 38 concentric with the axis of the shaft 31 and extends inwardly beyond the inner end of the rotor 35.

The rotor 35 has a plurality of longitudinally extending slots 39 placed circumferentially thereof and extending in a plane passing through the axis of the shaft 31. These slots 39 extend entirely through the rotor 35 to the bore 38. A plurality of blades 40, of which four are herein illustrated, are slidably mounted within the slot 39 of the rotor 35 and have arcuate outer surfaces engageable with the inner peripheral surface of the chamber provided by the opening 36. These blades 40 extend inwardly within the bore 38 and have arcuate ends engageable with a roller member 41 disposed longitudinally within the bore 38, as more clearly shown in Fig. 2. This roller member 41 has its axis substantially concentric with the axis of the opening 36 in the member 23, but eccentric with respect to the axis of the shaft 31 and normally tends to maintain the outer ends of the blades 40 in engagement with the inner peripheral surface of the chamber. The depth of the blades 40 is substantially the same as the depth of the rotor 35 and both are adapted to engage the inner adjacent surface of the flange 22 and the cap 24 to provide a substantially fluid-tight joint.

An inlet recess 42 and an outlet recess 43 are disposed, respectively, upon opposite sides of the chamber and are in communication therewith with the engaging portion 37 between the rotor and chamber disposed therebetween. These recesses are provided in the member 23 and are of a lesser depth than the depth of the rotor 35, as clearly shown in Fig. 2. It will also be noted that the extremities of the recesses 42 and 43 extend to substantially a distance corresponding to the distance between the outer edges of adjacent blades 40. An opening 44 is provided in the member 23 and communicates at its upper end with the recess 42, thus providing a fluid inlet passageway, while a similar opening 45 is provided in the member 23 having its upper end communicating with the recess 43, thus providing a fluid outlet passageway. The openings 44 and 45 extend downwardly to the lower end of the member 23 and are interiorly screw threaded to receive screw threaded plugs 46 for sealing the ends of the openings. The lower end of the member 23 is provided with a transverse opening 47 to receive the body portion of a headed member 48. The offset between the head and body portion of the headed member 48 is engageable with one side of the member 23 and is secured in place by a screw threaded nut 49 engageable with the screw threaded end of the headed member 48. The headed member 48 is provided with an opening 50 communicating with the inlet opening 44 and an opening 51 communicating with the outlet opening 45. These openings 51 and 45 may be connected with fluid inlet and outlet means, not shown.

If the device is to be used as a fluid pump an external gear 52 has a hub portion 53 rotatably mounted upon a reduced end 54 of the member 21 and is connected by means of a washer 55 secured respectively with the external gear 52 and a reduced end 56 upon the shaft 31. The reduced end 56 is exteriorly screw threaded and has a nut 57 mounted thereon and secured in place by a suitable locking means 58. A washer 59 is disposed between the nut 57 and the washer 55.

The capacity of the pump may be varied to meet the necessary requirements for which the device is intended by changing the relationship of the axis of the chamber defined by the opening 36 with respect to the axis of the rotor 35 which results in increasing or diminishing the clearance at the point 37 between the rotor and inner peripheral surface of the chamber. Likewise, the operation of the pump may be reversed by adjusting the plate 23 so as to position the axis of the chamber upon the opposite side of the axis of the shaft 31 from that shown in the figures. The adjustment of the plate may be accomplished by loosening the bolts 27 so as to unclamp the plate 23 and, after the latter has been adjusted to its desired position, the same may be reclamped by tightening the bolts 27. The adjustability of the plate is permitted by reason of the elongated openings 29 provided in the plate 23. With this type of pump it is possible to adjust the pump to the desired capacity by means of a micrometer placed about the outer side of the flange 22 and the outer side of the headed member 48.

In Figures 3 and 4 a slightly different construction of a pump embodying the invention is disclosed, it being possible, however, to similarly adjust the pump to obtain any desired capacity. Furthermore, in this construction it will be noted that the rotor is not supported upon its opposite sides, as is the construction of the pump disclosed in Figs. 1 and 2. This pump has a base 60 and an upwardly extending portion 61 at its forward end. A laterally extending bearing member 62 is formed integral with the upright portion 61 at its forward end and has an axial bore 63 provided therein. A web 64 is formed integral with the base 60 and the bearing portion 62 to reenforce the latter. A shaft 65 is rotatably mounted within the bore 63 and has a reduced screw threaded extension 66 provided upon one end. At the opposite end the shaft 65 is provided with an integral rotor 67 concentric with the axis of the shaft 65 and of somewhat larger diameter. A member 68 is positioned upon the outer side of the upright portion 61, while a cap 69 engages the opposite side of the member 68, as clearly shown in Fig. 4. This cap 69 is secured to the member 68 by means of bolts 70, while the members 68 and 69 are secured to the upright portion 61 by means of a plurality of bolts 71 having screw threaded engagement with openings 72 provided in the upright portion 61. The aligned openings 73 provided in the members 68 and 69, through which the bolts 71 extend, are elongated in a vertical direction, as viewed in the figures, so that the member 68 may be adjusted with respect to the axis of the shaft 65. The member 68 is provided with a transversely extending opening 74 forming a fluid chamber, the axis of which is eccentric with respect to the axis of the shaft 65. The rotor 67 is adapted to have running engagement with the inner peripheral surface of the chamber at a point indicated by 75, but, of course, the distance between the rotor and the peripheral portion of the chamber may be varied depending upon the desired capacity of the pump.

The end of the shaft 65 adjacent the rotor has

an axial bore 76 extending inwardly slightly beyond the end of the rotor, while the rotor is provided with a plurality of slots 77 extending inwardly to the bore 76. There are four of these slots illustrated and extend in planes passing through the axis of the shaft 65. A plurality of blades 78 are slidably mounted within the slots 77 and have arcuate outer ends engageable with the inner peripheral surface of the chamber or opening 74. The inner ends of the blades 78 are also arcuate and engage a roller member 79 disposed within the bore 76 and having its axis concentric with the axis of the chamber or opening 74. This roller member is slightly different from the roller member 41 shown in Figs. 1 and 2, in that it is a resilient split tube adapted to exert an outward force upon the ends of the slidable blades 78 to maintain the latter in engagement with the inner peripheral surface of the chamber. The roller member is diagonally severed, as shown at 80, so as to prevent engagement of the inner ends of the blades with the entire length of the slot at any one position.

The upper end of the member 68 is provided with an opening 81 within which is disposed one end of a threaded stud 82. The end of the stud is secured within the member 68 by means of a pin 83 disposed in aligned transverse openings in the member 68 and the stud 82, respectively. The threaded end of the stud 82 extends through an opening 84 provided in a lateral extension 85 formed integral with the upright portion 61. An adjusting nut 86 is mounted upon the screw threaded end of the stud 82 and engages the under surface of the lateral extension, while a locking nut 87 is mounted upon the outer end of the stud and engages the outer side of the lateral extension to secure the member 68 in any desired adjusted position. The member 68 may be adjusted by loosening the bolts 71, the nut 87, and turning the nut 86 in the desired direction so as to raise or lower the member 68 thereby changing the relationship of the axis of the rotor with respect to the axis of the fluid chamber.

An inlet recess 88 and an outlet recess 89 are provided in the member 68 upon the opposite sides of the fluid chamber with the contact point 75 therebetween. An inlet opening 90 is provided in the member 68 and communicates with the recess 88 to provide a fluid inlet passageway, while an opening 91 is provided upon the opposite side of the member 68 and communicates with the recess 89 to provide a fluid outlet passageway.

In Figs. 5 and 6 a still different type of pump construction is illustrated, but embodying the same invention. This pump is particularly designed as a fluid pump for use in connection with aircrafts. The construction is compact and the operation very efficient. The diameter of the fluid chamber can be kept relatively small for a given capacity thereby keeping the surface speed of the rotor to a minimum, which insures against seizure coming while within the requirements of a dry run test where the temperature cannot exceed a predetermined degree. The weight of the slidable blades is likewise maintained at a minimum and, due to centrifugal force under high speed, effects an efficient sealing between the outer ends of the blades and the inner peripheral surface of the fluid chamber. This pump is reversible and can also be used as a driving means or function as a liquid or air motor.

The pump consists of an elongated housing 92 closed at one end and open at the other and having an axial bore 93 provided therein. A bushing 94 is disposed within the bore 93 and abuts the closed end of the housing 92, as clearly shown in Fig. 5. A bushing 95 is also disposed within the bore 93 and in spaced relation with respect to the bushing 94 a member 96 is disposed within the bore 93 between the bushings 94 and 95 and is prevented from rotation with respect to the housing by means of a pin 97 secured in the housing and disposed within a longitudinally extending groove 98 upon the upper portion of the member 96. This member 96 has a transversely extending circular opening 99, the axis of which is eccentric with respect to the axis of the bore 93 and provides a fluid chamber. A shaft 100 extends axially of the housing and has enlarged bearing portions 101 spaced apart and rotatably supported within aligned openings 102 provided in the adjacent ends of the bushings 94 and 95. The shaft 100 has an integral rotor 103 of enlarged diameter extending between the bearing portions 101, the axis of which is concentric with the axis of the shaft 100, but eccentric with respect to the axis of the chamber. The rotor 103 is normally adapted to engage the inner peripheral surface of the chamber at a point indicated by 104 and an axial bore 105 extends outwardly beyond the outer end of the rotor. The rotor 103 is further provided with a plurality of longitudinally extending slots 106 extending from the outer periphery thereof into the bore 105. These slots 106 extend in planes which pass through the axis of the rotor and have blades 107 slidably mounted therein. The outer ends of the blades are arcuate and engage the inner peripheral surface of the chamber and likewise the inner ends of the blades are arcuate and engage with a roller member 108 disposed within the bore 105. The axis of the roller member 108 is eccentric with respect to the axis of the rotor and tends to maintain the outer ends of the blades in engagement with the inner peripheral surface of the chamber. The open end of the housing 92 is interiorly screw threaded to receive a plug 109, the inner end of which abuts with the bushing 95 and tends to maintain the operating parts in assembled relation. This plug 109 has an axial bore 110 through which the shaft 100 extends and around the shaft is a cork gasket 111 adapted to prevent the escapement of fluid along the shaft. The plug 109 is interiorly screw threaded at its forward end to receive a screw threaded plug 112, the inner end of which engages the cork gasket 111 and tends to compress the same into fluid-tight engagement with the shaft 100. The plugs 109 and 112 have aligned openings 113 which communicate at one end with the shaft 100 and at the opposite end with an opening 114 to which a suction tube may be connected for the purpose of determining whether there is any leakage of fluid along the shaft 100 past the cork gasket 111.

Openings 115 are provided in the member 96 upon opposite sides of the chamber and communicate respectively with a fluid inlet opening 116 and a fluid outlet opening 117 provided in the housing 92.

It will be seen that with this construction the bushings 94 and 95 may be replaced in the event of excessive wear and, likewise, the member 96 may be removed from the bore of the housing and replaced in case of wear or other accident. Likewise, in all of the constructions, so far described, the blades are reversible as well as interchange-

able and, in the event of excessive wear taking place upon the blades, the roller member may be removed and a roller member of slightly larger diameter substituted so as to compensate for the wear upon the blades and maintain the outer ends of the blades in engagement with the inner peripheral surface of the chamber.

In Figs. 7 to 12, inclusive, more or less diagrammatic arrangements are disclosed to particularly illustrate the construction and arrangement of various types of blades which may be employed in connection with the pumps, heretofore described. In Figs. 7 and 8 the housing of the pump is indicated by 118 and has a circular opening 119 therein to provide a fluid chamber. A rotor 120 is disposed within the fluid chamber and is provided with an integral rearwardly extending shaft 121 which is mounted in a suitable bearing 122 for rotation about an axis eccentric with respect to the axis of the chamber or opening 119. An axial bore 123 is provided in the rotor 120 upon the side opposite to the shaft 121. The rotor 120 is also provided with a plurality of longitudinally extending slots 124 extending through the rotor to the bore 123. The axis of the rotor is so positioned with respect to the axis of the chamber or opening 119 that a running engagement is provided at a point 125 between the outer peripheral surface of the rotor 120 and the inner peripheral surface of the chamber 119. Furthermore, a fluid inlet opening 126 is provided in the housing and communicates with the chamber 119, while an outlet opening 127 is also provided in the housing and communicates with the chamber 119. The outlet opening may be provided with a spring pressed valve 128 to offer a resistance to the passage of fluid therethrough. The inlet and outlet openings are normally positioned upon opposite sides of the point of engagement 125 when rotation of the rotor 120 is in the direction indicated by the arrow in Fig. 7. A plurality of blades 129 are slidably mounted within the slots 124 and engaging at their outer ends with the inner peripheral surface of the chamber 119, while their inner ends are in engagement with a loosely mounted roller 130 disposed within the bore 123 with the axis of the roller member concentric with respect to the axis of the chamber 119, but eccentric with respect to the axis of the rotor 120.

In this particular construction the opposite ends of the blades 129 are of arcuate curvature and have a common radius 131 struck from a point within the blade structure located in a plane 132 passing through the points of engagement between the outer ends of the blades and the inner peripheral surface of the chamber, the inner ends of the blades and the outer peripheral surface of the rotor member, and the axis of the rotor member. By providing this relationship it is possible to distribute the wear upon the ends of the blades substantially throughout the entire surface area.

Figs. 9 and 10 illustrate a further modification of the rotor and blade structure in which the pump consists of a housing 133 having a circular opening 134 therein providing a fluid chamber. The housing has a fluid inlet opening 135 and a fluid outlet opening 136 communicating with the chamber 134 in a manner explained in connection with Fig. 7. A rotor 137 is disposed within the chamber 134 and has an integral shaft 138 at one side thereof which is rotatably mounted in bearings 139, the axis of which is eccentric with respect to the chamber 134. The rotor 137 is provided with an axial bore 140 on the side opposite to the shaft 138 and also has a longitudinally extending slot 141 extending through the rotor to the bore 140. A blade 142 is slidably mounted within the slot 141 and has its outer end engageable with the inner peripheral surface of the chamber 134 while the inner end is engageable with a roller member 143 disposed within the bore 140 with its axis concentric with respect to the axis of the chamber 134, but eccentric with respect to the axis of the shaft 138. Where a single blade is employed, as shown in this construction, the roller member 143 must be secured against movement with respect to its axis and consequently the roller member is provided with an extension 144 secured within an adjacent portion of the housing. The outer end of the blade contacts throughout its entire length with the inner peripheral surface of the chamber 134, but the inner end of the blade is cut away at 145 for purpose of clearance, the inner engaging end of the blade, however, engaging throughout its entire length and so far as its engagement with the roller member 143 is concerned. In the blade illustrated in Fig. 9 the opposite ends of the blade 142 are arcuate, but are struck with different radii from a common center, the outer surface being arcuate and struck from a radius 146, while the inner end is struck from a different radius 147, but from the same center. The common center lies in a plane passing through the point of engagement between the outer end of the blade and the inner peripheral surface of the chamber 134, the inner engaging surface of the blade, and the outer peripheral surface of the roller member 143 and the axis of the roller member. The purpose here again is to distribute the wear equally over the entire contacting surface.

In Figs. 11 and 12 a still further construction is illustrated in which a pump consists of a housing 148 having its circular opening 149 therein providing a fluid chamber. An inlet opening 150 and an outlet opening 151 are also provided in the housing and communicate with the chamber 149. A rotor 152 is disposed within the chamber 149 and has an integral shaft 153 rotatably mounted in bearings 154 about an axis eccentric with respect to the axis of the chamber 149. The rotor 152 is provided with an axial bore 155 in the end opposite to the shaft 153 and also is provided with a longitudinally extending slot 156 extending through the rotor to the bore 155. A blade 157 is slidably mounted within the slot 156 and has its outer end in engagement with the inner peripheral surface of the chamber 149. The inner end of the blade is provided with laterally extending spaced lugs 158 which receive therebetween the free end of an arm 159 formed integral with a sleeve 160'. The sleeve is loosely mounted upon the inner end of a pin 160 having its opposite end secured in an adjacent portion of the housing. The lugs 158 and the adjacent end of the arm 159 are provided with aligned openings through which extends a bushing 161. At the opposite ends of the lugs 158 circular washers 162 are provided and a pin 163 extends through aligned openings in the washer and bushing and have their opposite ends riveted or otherwise secured so as to maintain the member in assembled relation.

In this particular construction the outer end of the blade is arcuate and is struck from a radius 164, the center of which is common with the axis of the pin 163. This common center or axis lies

in a plane passing through the point of engagement between the outer surface of the blade and the inner peripheral surface of the chamber 149 and the axis of the pin 160.

In Figs. 7 to 12, inclusive, various types of blades having been illustrated, but it is to be understood that any of the blades may be used in any of the different structures, that is, the type of blade shown in Fig. 9 may be substituted for the type of blade shown in Fig. 7 at the same time employing a plurality of blades in the structure.

In all of the constructions, upon the rotation of the rotors, the outer ends of the slidable blades are maintained in engagement with the inner peripheral surface of the chamber by reason of the roller member which engages with the inner ends of the blades. As the blades pass the fluid inlet opening a suction is created drawing the fluid into one of the spaces between the adjacent blades as the capacity increases and then the fluid is forced towards the outlet opening, while at the same time being compressed so that it is ultimately ejected through the outlet opening at considerable pressure. In employing four blades it has been found that the pump discharges substantially evenly without any indication of pulsations. The device, of course, may be used as a pump, or may be used as a pump or a motor as may be desired.

While I have described the preferred embodiment of the invention it is to be understood that I am not to be limited thereto, inasmuch as changes and modifications may be resorted to without departing from the spirit of the invention as defined in the appended claims.

Having thus described my invention, I claim:

1. A rotary pump comprising a housing having an axial bore therein closed at one end and provided with fluid inlet and outlet openings, a bushing mounted in said bore adjacent the closed end and having an axial opening therethrough, a second bushing mounted in said bore in spaced relation with respect to said first-mentioned bushing and having an axial opening therein, a liner mounted in said bore between said bushings and having a circular opening extending therethrough, the axis thereof being offset but parallel with respect to the axis of said bushing openings, said liner having openings connecting the circular opening thereof with the fluid inlet and outlet openings, a rotor positioned in said circular opening and having extensions rotatably mounted in the bushing openings, said rotor having an axial bore extending inwardly from the closed end of said housing and having a running engagement with the inner periphery of said liner between the fluid inlet and outlet openings, said rotor having longitudinal slots extending through the wall thereof in spaced, angular relation, blades slidably mounted in said slots and having their outer ends engageable with the inner periphery of said liner, a roller member positioned in the bore of said rotor and engageable with the inner ends of said blades for normally maintaining the latter in predetermined relation, a shaft connected to the closed end of said rotor and extending outwardly axially thereof beyond said housing, and detachable means closing the open end of said housing.

2. A rotary pump comprising a housing having an axial bore therein closed at one end and provided with fluid inlet and outlet openings, a bushing mounted in said bore adjacent the closed end and having an axial opening therethrough, a second bushing mounted in said bore in spaced relation with respect to said first-mentioned bushing and having an axial opening therein, a liner mounted in said bore between said bushings and having a circular opening extending therethrough, the axis thereof being offset but parallel with respect to the axis of said bushing openings, said liner having openings connecting the circular opening thereof with the fluid inlet and outlet openings, a rotor positioned in said circular opening and having extensions rotatably mounted in the bushing openings, said rotor having an axial bore extending inwardly from the closed end of said housing and having a running engagement with the inner periphery of said liner between the fluid inlet and outlet openings, said rotor having longitudinal slots extending through the wall thereof in spaced angular relation, blades slidably mounted in said slots and having their outer ends engageable with the inner periphery of said liner, a roller member positioned in the bore of said rotor and engageable with the inner ends of said blades for normally maintaining the latter in predetermined relation, a shaft connected to the closed end of said rotor and extending outwardly axially thereof beyond said housing, a plug removably mounted in the open end of said housing and having its inner end abutting the adjacent end of said second-mentioned bushing, said plug having an axial opening encircling said shaft, a packing member surrounding said shaft and disposed within said plug opening adjacent said second mentioned bushing, and a member removably mounted in said plug opening for maintaining said packing in place.

3. A rotary pump comprising a housing having an axial bore therein closed at one end and provided with fluid inlet and outlet openings, a bushing mounted in said bore adjacent the closed end and having an axial opening therethrough, a second bushing mounted in said bore in spaced relation with respect to said first-mentioned bushing and having an axial opening therein, a liner mounted in said bore between said bushings and having a circular opening extending therethrough the axis thereof being offset but parallel with respect to the axis of said bushing openings, said liner having openings connecting the circular opening thereof with the fluid inlet and outlet openings, means for securing said liner against rotative movement within said bore, a rotor positioned in said circular opening and having extensions rotatably mounted in the bushing openings, said rotor having an axial bore extending inwardly from the closed end of said housing and having a running engagement with the inner periphery of said liner between the fluid inlet and outlet openings, said rotor having longitudinal slots extending through the wall thereof in spaced angular relation, blades slidably mounted in said slots and having their outer ends engageable with the inner periphery of said liner, a roller member positioned in the bore of said rotor and engageable with the inner ends of said blades for normally maintaining the latter in predetermined relation, a shaft connected to the closed end of said rotor and extending outwardly axially thereof beyond said housing, and detachable means closing the open end of said housing.

4. A rotary pump comprising a housing having an axial bore therein and fluid inlet and outlet passageways, members mounted in said bore and spaced apart to provide a circular chamber

communicating with said passageways, the axis of said circular chamber being offset but parallel with respect to the axis of said bore, a cylindrical rotor disposed in said chamber and extending from member to member, said rotor being of smaller diameter than the diameter of said chamber and having its axis coaxial with the axis of said axial bore so as to provide a running engagement between said rotor and the inner periphery of said chamber between said fluid inlet and outlet passageways, integral reduced axial extensions on the opposite ends of said rotor rotatably journalled in the adjacent members, an axial shaft integrally connected to one of said extensions and projecting outwardly beyond said housing, said rotor and other extension having an axial bore of lesser diameter than said extension and terminating in said extension to which said shaft is connected, longitudinal slots spaced angularly extending through the wall of said rotor into communication with the bore thereof, blades slidably mounted in said slots and having their outer ends adapted for running engagement with the inner periphery of said chamber, and a roller member insertable through the open end of said extension and extending substantially throughout the length of said bore, said roller member being adapted for engagement with the inner ends of said blades for maintaining the latter in predetermined spaced relation and having a rolling contact therewith.

5. A rotary pump comprising a housing having an axial bore therein and fluid inlet and outlet passageways, members mounted in said bore and spaced apart to provide a circular chamber, a liner secured in said chamber between said members and having an axial bore the axis of which is offset but parallel with the axis of said chamber, said liner having openings communicating with said fluid inlet and outlet passageways, a cylindrical rotor disposed in said liner and extending from member to member, said rotor being of smaller diameter than the diameter of said chamber and having its axis coaxial with the axis of said axial bore so as to provide a running engagement between said rotor and the inner periphery of said chamber between said fluid inlet and outlet passageways, integral reduced axial extensions on the opposite ends of said rotor rotatably journalled in the adjacent members, an axial shaft integrally connected to one of said extensions and projecting outwardly beyond said housing, said rotor and other extension having an axial bore of lesser diameter than said extension and terminating in said extension to which said shaft is connected, longitudinal slots spaced angularly extending through the wall of said rotor into communication with the bore thereof, blades slidably mounted in said slots and having their outer ends adapted for running engagement with the inner periphery of said liner, and a roller member insertable through the open end of said extension and extending substantially throughout the length of said bore, said roller member being adapted for engagement with the inner ends of said blades for maintaining the latter in predetermined spaced relation and having a rolling contact therewith.

6. A rotary pump comprising a housing having an axial bore therein closed at one end and provided with fluid inlet and outlet openings, a bushing mounted in said bore adjacent the closed end and having an axial opening therethrough, a second bushing mounted in said bore in spaced relation with respect to said first-mentioned bushing and having an axial opening therein, a liner mounted in said bore between said bushings and having a circular opening extending therethrough, the axis thereof being offset but parallel with respect to the axis of said bushing openings, said liner having openings connecting the circular opening thereof with the fluid inlet and outlet openings, a rotor positioned in said circular opening and having extensions rotatably mounted in the bushing openings, said rotor having an axial opening and a running engagemet with the inner periphery of said liner between the fluid inlet and outlet openings, said rotor having longitudinal slots extending through the wall thereof in spaced, angular relation, blades slidably mounted in said slots and having their outer ends engageable with the inner periphery of said liner, a roller member positioned in said axial opening of said rotor and engageable with the inner ends of said blades for normally maintaining the latter in predetermined relation, a shaft connected to said rotor and extending outwardly axially thereof beyond the open end of said housing, and detachable means closing the open end of said housing.

7. A rotary pump comprising a housing having a circular chamber therein, a rotor eccentrically positioned within said chamber and rotatably mounted in said housing, said rotor having an axial bore therein, a blade slidably mounted in said rotor and having its outer end engageable with the inner peripheral wall of said chamber, and an elongated roller member disposed within said bore and engageable with the inner end of said blade to maintain the latter in predetermined position, said blade having arcuate opposite ends of different radii struck from a common center which lies in a plane passing through the points of engagement between the outer end of said blade and the inner peripheral wall of said chamber and the inner end of said blade and the outer peripheral surface of said roller member, the outer end of said blade having the larger radius.

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